

# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY


(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

REC'D 09 AUG 2005

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Applicant's or agent's file reference 35067PC01		<b>FOR FURTHER ACTION</b>		See Form PCT/PEA/416
International application No. PCT/DK2004/000395		International filing date (day/month/year) 10.06.2004	Priority date (day/month/year) 12.06.2003	
International Patent Classification (IPC) or national classification and IPC H01S3/06, H01S3/063				
Applicant DANMARKS TEKNISKE UNIVERSITET				
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 5 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau a total of 20 sheets, as follows:</p> <p><input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>				
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the opinion</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>				
Date of submission of the demand 26.04.2005		Date of completion of this report 10.08.2005		
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016		Authorized Officer Hervé, D Telephone No. +31 70 340-4285		



**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/DK2004/000395

**Box No. I Basis of the report**

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4)
  - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements\*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

**Description, Pages**

1-15  
filed with telefax on 26.04.2005

**Claims, Numbers**

1-34  
filed with telefax on 26.04.2005

**Drawings, Sheets**

1/5-5/5  
as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing *(specify):*
  - ☐ any table(s) related to sequence listing *(specify):*
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing *(specify):*
  - ☐ any table(s) related to sequence listing *(specify):*

\* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/DK2004/000395

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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**1. Statement**

Novelty (N)	Yes: Claims	1-34
	No: Claims	
Inventive step (IS)	Yes: Claims	1-34
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-34
	No: Claims	

**2. Citations and explanations (Rule 70.7):**

**see separate sheet**

**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

- D1 : CHERN: (QELS) Trends in optics and phot. (TOPS), v. 74, 19/05/2002, pg 25-26;  
D2 : US 4 955 034 A (1990-09-04) ;  
D3 : BEN MESSAOUD: Organic materials for device applications, F E-MRS,  
vol. 138, no. 1-2, 18 June 2002 pages 347-351, XP002273018 ;  
D4 : SASAKI M: Int. Microprocesses and Nanotechn. Conf., 11-13 July 2000,  
vol. 39, no. 12B, pages 7145-7149, Jap. J. of Ap. Phys., Part 1, Dec. 2000.

**I Independent Claim 1**

1. The document D1 discloses (the references in parentheses applying to this document):  
An optical device for providing optical amplification comprising:  
- a substrate (see paragraph 2 line 3);  
- a polymer structure (paragraph 2, line 1) provided on the substrate in a predetermined shape defined by a number of sidewalls n (paragraph 3 line 1, "square" meaning 4 walls), and being doped with an optically active medium (paragraph 3 line 1, "dye doped"), wherein the sidewalls of the structure form a cavity resonator so that an electromagnetic wave upon pumping of the device is emitted laterally (fig. 1a).

The subject-matter of claim 1 differs from this known document D1 in that in claim 1 the polymer is a photo-definable polymer, while in D1, D3 and D4 the employed polymer is PMMA which is not sufficiently photo sensitive to enable the material to be structured via UV photolithography.

The subject-matter of claim 1 is therefore new (Article 33(2) PCT).

2. The problem to be solved by the present invention may be regarded as how to simplify the fabrication process of polymer laser microstructures.

The solution offered by claim 1 is to use a photo definable polymer as the Laser active material which allows for easy and versatile fabrication of the cavity without application or subsequent removal of a photo-resist. By employing the photo-resist itself as laser material several process steps can be omitted reducing both costs and time.

3. The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons:

In the prior art as disclosed by D1-D4, PMMA is used to form laser cavities. It is known to the man skilled in the art that these structures can be manufactured via photolithography or e-beam or X-ray lithography. Photolithography being the simplest and cheapest method, the man skilled in the art would chose photolithography to manufacture these laser

cavities.

D3 (and probably D1) teaches to apply the photolithography process to realize PMMA/Dye based laser cavities by applying a photoresist on top of the PMMA/dye mixed layer, as PMMA is not suitable for direct photolithography. D4 teaches the use of Silicon mold for casting the PMMA/dye mixture.

The man skilled in the art, faced with the objective problem of simplifying the fabrication process of polymer laser microstructures, would not replace PMMA as the laser material with a photo-definable polymer, for the following reasons:

- it is generally believed that photo-sensitive polymer are not suitable to act as laser material, as one would expect the laser radiation generated in the polymer to be absorbed by said polymer or worse that said laser radiation could deteriorate said polymer. D4 for instance states that the low absorption of PMMA is an advantage (paragraph linking col: 4 and 5);
- none of the prior art mention problems associated with PMMA nor do they give a hint to use an alternative material. Therefore, replacing PMMA as the active material would require a complete new research program going clearly beyond the capacities of the ordinary skilled person.

Therefore the skilled man faced with the objective problem stated above would try to improve the fabrication methods disclosed by the prior art by optimizing process parameters but not by doing fundamental changes with respect to the lasing material.

The subject-matter of claim 1 does therefore involve an inventive step (Article 33(2) PCT).

**II Further independent Claims 2, 22, 24, 30**

The same reasoning applies mutatis mutandis to the other independent claims as all of them are based on photo-definable polymer structure defining a resonator.

**III Dependent claims**

Claims 3-21, 23, 25-29, 31-34 are dependent on claims 1, 2, 22, 24, 30 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

**IV Additional comments when entering the European Phase**

The set of claims on files does not meet the requirements of Rule 29(2) EPC. It would accelerate the procedure if the applicant would file only one independent claim per category on entering the EP phase.

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